

Patent Claims

1. A superimposed steering system for a vehicle, in particular for a power steering system or a power assistance steering system for a motor vehicle, having a variable ratio gear unit (4) which has a first gear unit input shaft (2) and a second gear unit input shaft (3) and is configured as a harmonic drive (11) for the superimposition of the rotational angles which occur at the two gear unit input shafts (2, 3) onto a gear unit output shaft (5) of the variable ratio gear unit (4), which gear unit output shaft (5) acts on an input shaft (6) of a steering gear (7), the first gear unit input shaft (2) being operatively connected to a steering handle (9) via a steering shaft (8) and the second gear unit input shaft (3) being operatively connected to a servomotor (10), the first gear unit input shaft (2) being connected releasably to a radially flexible flexspline (13) of the harmonic drive (11) and penetrating an eccentric drive core (12) of the harmonic drive (11), said eccentric drive core (12) protruding into the radially flexible flexspline (13), characterized in that the torque of the servomotor (10) is supported on another component (17), fixed to the vehicle, of the superimposed steering system (1) or the vehicle than on a steering column.
2. The superimposed steering system as claimed in claim 1, characterized in that the servomotor (10) provides a torque and rotational angle to the eccentric drive core (12) on the second gear unit input shaft (3) of the harmonic drive (11), and the radially flexible flexspline (13) is connected to the first gear unit input shaft (2) in a form-fitting and releasable manner, and one or more circumferential sections of an outer circumferential surface (14) of the radially flexible flexspline (13) is

in engagement in a continuously changing manner with a substantially cylindrical supporting surface (15) of a circular spline (16) which is connected fixedly in terms of rotation to the gear unit output shaft (5).

3. The superimposed steering system as claimed in either of claims 1 and 2, characterized in that the radially flexible flexspline (13) is fixed on the first gear unit input shaft (2) with a connecting element (18) and a clutch plate (19).
4. The superimposed steering system as claimed in one of claims 1 to 3, characterized in that the eccentric drive core (12) is mounted on the first gear unit input shaft (2) via roller bearings (20, 20') at its axial ends (21, 21').
5. The superimposed steering system as claimed in claim 4, characterized in that an outer or inner ring (22, 23) of a roller bearing (20, 20') is prestressed axially.
6. The superimposed steering system as claimed in claim 5, characterized in that the outer ring (22) or the inner ring (23) of the roller bearing (20, 20') is prestressed axially with a disk spring (24).
7. The superimposed steering system as claimed in claim 6, characterized in that the disk spring (24) is supported on the clutch plate (19) via the radially flexible flexspline (13).
8. The superimposed steering system as claimed in one of claims 1 to 7, characterized in that the first gear unit input shaft (2) is mounted in the circular spline (16) with a bearing (25).

9. The superimposed steering system as claimed in claim 8, characterized in that the bearing (25) is configured as a needle bush (26).
10. The superimposed steering system as claimed in either of claims 8 and 9, characterized in that the first gear unit input shaft (2) is mounted in the bearing (25) with a form-fittingly releasable bearing journal (27).
11. The superimposed steering system as claimed in claim 10, characterized in that a depression (28) whose cross section deviates from the circular shape is arranged in the bearing journal (27).
12. The superimposed steering system as claimed in one of claims 1 to 11, characterized in that the servomotor (10) is operatively connected to the second gear unit input shaft (3) via a gear unit (29).
13. The superimposed steering system as claimed in claim 12, characterized in that the gear unit (29) is a gear mechanism, such as a spur gear mechanism, a helical gear mechanism or a bevel gear mechanism.
14. The superimposed steering system as claimed in claim 13, characterized in that the eccentric drive core (12) is of one-piece configuration with the second gear unit input shaft (3) and a gear wheel of the gear unit (29).
15. The superimposed steering system as claimed in claim 12, characterized in that the gear unit (29) is configured as a flexible drive mechanism (30).

16. The superimposed steering system as claimed in claim 15, characterized in that the eccentric drive core (12) and the second gear unit input shaft (3) are of one-piece configuration with a pulley wheel (31) of the gear unit (29).
17. The superimposed steering system as claimed in one of claims 1 to 11, characterized in that the eccentric drive core (12) is formed in one piece with a servomotor shaft (32) which forms the second gear unit input shaft (3).
18. The superimposed steering system as claimed in claim 17, characterized in that the servomotor (10) is configured as a hollow shaft motor (33), a rotor (34) of the servomotor (10) being arranged rotatably about the steering shaft (8).
19. The superimposed steering system as claimed in one of claims 1 to 18, characterized in that the current supply and/or the signal forwarding to the servomotor (10) takes place without a transfer device such as sliders or flat spiral springs.
20. The superimposed steering system as claimed in one of claims 1 to 19, characterized in that the harmonic drive (11) is formed substantially from steel.
21. The superimposed steering system as claimed in one of claims 1 to 19, characterized in that the harmonic drive is formed substantially from plastic.
22. The superimposed steering system as claimed in one of claims 1 to 21, characterized in that the flexspline (13) has an external toothing system (35) which is in

engagement with an internal toothing system (36) of the circular spline (16).

23. The superimposed steering system as claimed in one of claims 1 to 22, characterized in that the variable ratio gear unit (4) is arranged between a steering valve and the steering gear (7) or between the steering handle (9) and the steering valve in the case of a hydraulic power assistance steering system.
24. The superimposed steering system as claimed in one of claims 1 to 22, characterized in that the variable ratio gear unit (4) is arranged between a steering moment sensor and the steering gear (7) or between the steering handle (9) and the steering gear (7) in the case of an electric power assistance steering system.
25. The superimposed steering system as claimed in one of claims 2 to 24, characterized in that the harmonic drive (11) is installed between the steering handle (9) and the steering gear (7) in such a way that the circular spline (16) is connected fixedly in terms of rotation to the steering handle (9) and the radially flexible flexspline (13) is connected fixedly in terms of rotation to the gear unit output shaft (5).